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Abstract

EVALUATION OF DIFFERENTIAL DOSE DISTRIBUTION IN HUMAN PHANTOM USING S^{32} (n,p) P^{32} REACTION IN HAIR

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In certain reactor accidents, human subjects are sometimes exposed to neutron beams which deliver unknown neutron dose to different human organs. The S^{32} (n,p) P^{32} reaction due to neutrons of energy greater than 2 MeV was used as basis for neutron dose measurements. The neutron source was one of the horizontal neutron beams of the U.A.R. water-water cooled reactor and the sulphur present in human hair (30-50% dry weight) was the target material for neutron detection. Samples of human hair were placed at specific points of standard man phantom, which represent active bone marrow and gonads. The bone marrow was represented by the Ribs 1 to 4, 5 to 8, 9 to 12, Cranium and mandible Scapulae, humeral heads and clavicles - Sternum - Sacrum - Os Coxae - Femoral head and neck - Cervical Vertebrae - Thoracic Vertebrae 1 to 4, 5 to 8, 9 to 12 and Lumbar Vertebrae. The gonads were represented by left and right ovaries for female, and scrotum for male. The standard man was designed and constructed locally from a real human skeleton, filled with sherezine wax. Lungs were assembled in the form of two plastic bags filled with wet sawdust while intestines were replaced by strips of rubber foam soaked in paraffin. Samples of the same hair were also placed at certain points on the top of the phantom skull. The irradiation time and the positioning of the phantom in front of the neutron beam were chosen in a way to represent typical conditions of irradiation of occupational workers in case of accidents or negligence of protectional signs when neutron horizontal beams are left open during reactor operation. The sulphur and phosphorus content of these hair samples inserted in the phantom, were assumed to represent the case in vivo.

The experimental dose and dose rate data received by bone marrow, gonads and hair of the skull were used for derivation of certain parameters correlating the dose or dose rate received by the skull hair to that received by gonads and bone marrow for different irradiation conditioning and for different phantom positions. These parameters were tabulated in a certain form which could facilitate the assessment of gonad or bone marrow dose received by man after accidental neutron exposure.